AMRAD NEWSLETTER

Amateur Radio Research and Development Corporation July 1980

OUR JULY 7 MEETING will be the occasion for a talk by Dr. Michael J. Marcus of the Office of Science and Technology, Federal Communications Commission. The topic will be "Prospects for Amateur Packet Radio and Spread Spectrum". Dr. Marcus' job is to promote new technology, and he is interested in seeing meaningful, state-of-the art experimentation by radio amateurs. Guests and visitors are welcome, as always. The meeting will be at 7:30 p.m. in the Patrick Henry Branch Library, 101 Maple Ave E, Vienna, Virginia.

DAVE BORDEN'S PROTOCOL COLUMN in this issue contains a reprint of a progress report on PCNET written by Dave Caulkins. Dave Borden is receiving mail from all over the country, indicating widespread interest in the subject of network protocols. If you have something to contribute to the column, please write Dave Borden, K8MMO, Rt 2, Box 233B, Sterling, VA 22170.

For Those Who Are Left Wondering what this protocol business is all about, it might be worth a few words of explanation. For the past few years, there have been more and more computers in the hands of hobbyists. Many of these home computers have the hardware (i.e., a modem) that permit them to communicate with other computers via telephone lines or ham radio. Over 100 of these computers have been set up as Computer Bulletin Board Systems (CBBS's) for storage and retrieval of messages from individuals. Protocols (programs which provide the step-by-step process by which two computers can talk to each other) are needed to permit communication between computers, conceivably organized in a network. Many of us in AMRAD feel that the network should encompass both computer and radio amateurs as well as include some way of providing similar services for the deaf. Others have different ideas. The bottom line is that there will be some type of amateur data communications network(s) during the early 1980's. The Protocol column in the *AMRAD Newsletter* is open as a vehicle for exchange of ideas on protocols for amateur networking.

FM SUB-BAND ON 6 METERS WAS ELIMINATED by the FCC in a Report and Order on PR Docket 79-285, approved Thursday (May 29). Noting the wide diversity of opinion among those filing comments on its last-November proposal, the Commission decided to opt for "deregulation" and let the Amateur fraternity establish its own usage pattern for 50.1-54 MHz operation. 50.0-50.1 remains CW only. Effective date for the rules change has yet to be set. Thanks *HR Report*.

THE PERIPHERAL PEOPLE have established a national computer bulletin board for radio amateurs using MicroNET. It employs a free access program, called HAMNET. Using HAMNET the caller can post and retrieve messages for Help Wanted, Equipment for Sale, Net News, schedules, etc. Other features planned are propagation forecasts. FCC news, new product announcements and so forth. There is also a ham "frequency" so that two users may communicate or transfer programs. This service is called "HAMGAB". Subscriptions for MicroNET are available from Personal Computing Division, CompuServe Inc., 500 Arlington Centre Blvd., Columbus, OH 43220. For additional information on The Peripheral People, write PO Box 524, Mercer Island, WA 98040, or call 206-232-4505.

FROM NEW MEMBERS: Our interests are: 1. ASCII/Baudot CBBS for the deaf; 2. Help deaf young people earn ham licenses; 3. Promote 3rd-party use of ham radio by the deaf; 4. Any small-computer applications that benefit the deaf; 5. RTTY; 6. Relaying messages between CBBS systems at 1200 baud on phone lines during evening discount rate times; and, 7. Communicating with people with similar interests.

R. J. Caldwell, WA7RSZ
Cora Lou Caldwell, WA7YOJ
PO Box 291
Gooding, ID 83330

VOLUNTEERS HAVE COME FORWARD for these club activities: *Advertising Manager* - Bill Graff (publisher, *Business Review Newspaper*). *Newsletter Bulk Mailing* - Ted Riggs of Falls Church, VA. *Layout of p-c board for AAA1200 modem (described in April issue)* - Bill Callaghan. Bill will do the artwork for the printed-circuit board and build up the modem prototype. He will then turn the artwork over to someone (yet to be identified) who can handle the reproduction of the boards. Although we are not taking orders at this time, those interested in acquiring an AAA1200 board when available may wish to drop a post card to Bill at 6605 Fisher Ave, Falls Church, VA 22046. A volunteer is still needed to take over the AMRAD Library. If interested, please contact the current librarian, Bob Bruninga, 703-281-2762.

Protocol

THE PERSONAL COMPUTER NETWORK [PCNET] PROJECT:

A PROGRESS REPORT

BY DAVE CAULKINS
PCNET Project
1263 El Camino Real, Box E
Menlo Park, CA 94025

INTRODUCTION

This article describes the PCNET project, its goals, a brief history of activity, PCNET status today, and PCNET's future plans.

GOALS

The goal of the PCNET project is to provide a reliable, error free and low-cost means of transferring files, programs or messages among personal computers (PCs) via the dial-up telephone system or other media. To achieve this goal in a reasonable way the PCNET Project adopted a series of system design objectives:

1. PCNET software will be hardware- and operating-system independent; any PCNET-equipped computer will be able to communicate with any other PCNET-equipped computer.
2. PCNET will be adaptable to as broad a range of existing hardware and software systems as possible.
3. PCNET will be a distributed system; any two computers running PCNET software will be able to communicate with no requirement for additional centralized resources. However, this will not preclude time-sharing systems and other centralized services from running PCNET 'front ends' in order to communicate with PCNET equipped small computers.
4. PCNET will be capable of unattended operation; any two PCNET systems will be able to initiate a telephone connection, transfer information and terminate the connection without the presence of an operator at either end. This will allow PCNET systems to take advantage of the low telephone rates available from 11 PM to 8 AM.
5. No personal computer user will require more than a single telephone line to participate in PCNET.
6. PCNET will be layered; i.e., PCNET software will be divided into distinct functional layers. Communication between layers will be sparse and well defined. Any layer can be modified or even replaced with minimum effect on the others. This kind of design should make PCNET readily adaptable to changing opportunities in hardware and media. Modems are going to be capable of higher speeds, and communication by other media such as radio (see discussion of Packet Radio below) will become possible. Layering allows relatively easy accommodation to these technological advances.

PCNET History

The PCNET Project (then called the PCNET Committee) was started at the first West Coast Computer Faire in April of 1977. PCNET was and is a non-profit organization of volunteers; all PCNET developed software is placed in the public domain. PCNET is now part of People's Computer Company. The first year of PCNET activity produced a protocol design (a protocol is a set of conventions for computer-to-computer telecommunication) and some experimental software mechanizing protocol operation. This software was demonstrated at the second Faire in March of 1978; an 8080 based system in Santa Clara, CA sent a file to a PET at the Faire in San Jose, CA with both machines running PCNET software. Noise was deliberately introduced on the phone line to damage some blocks of data; the two machines successfully detected the bad blocks and retransmitted good ones.

In 1979 the TNW Corporation and PCNET developed PAN, a small electronic mail system. This sytem lacks the power of the full PCNET protocol, but is quite adequate for handling English text messages and allows people with limited telecommunications experience to get a feel for what telecommunication is all about. The first version of PAN runs in the Commodore PET and TNW488 modem; a program tape and instruction manual are available from P.C.C. for $12. We're working on a version for the Apple II and Micromodem II, and intend to do one for the TRS-80. See Appendices B and C for more information about PAN.

PCNET STATUS

PCNET Design Description. This section presents a brief description of PCNET design. Each PCNET installation is called a Node; it consists of a computer, a modem, and the PCNET software. The software will activate one of two capability levels: Simple, for machines of small size or limited resources, and Advanced, for more powerful machines. A 48K Apple II with a Micromodem II is an example of a machine which could become an Advanced node. In keeping with PCNET design objectives all nodes will be able to communicate in Simple mode, but two nodes able to switch to Advanced mode will be able to do more and do it faster. Node-to-node communication always starts in Simple mode, but switches to Advanced mode as soon as possible if both nodes can handle it.

Figure 1 shows a diagram of the PCNET layers as they are implemented in hardware and software in a PCNET node. The node that initiates a call (dials the phone) is called the originate node; the node that accepts a call (answers the phone) is called the answer node. Information starts at the top (server process) layer of the originate node, works its way down through the layers and across the phone line to the answer node. There it goes back up through the answer node layers to the server processes. At the top (server) layer in both nodes area the programs actually carrying out user functions—for example a File Transfer Program (FTP), an electronic mail program (MAILER), etc. PCNET can communicate data to and from several simultaneously active server programs.

Let's follow the sequence of events in detail, assuming that both FPT and MAILER are active, and that the phone connection to the answer node system has already been established. Starting at the top (server) layer in the originate node: each server process passes a stream of data to the Directing layer; MAILER is sending an electronic mail message,

and FTP is sending an object program to be executed later in the answer node computer.

Directing Layer. In this layer the two streams of data are broken up into Directed Blocks; each such block has a header with the address of the server process in the answer node to which it's to be delivered, and a data section containing a piece of actual data. The Directed Blocks are then passed to the Validating Layer.

Validating Layer. Here the Directed Blocks have additional header information added, and an error detecting code appended to the end of each block. The resulting Validated Blocks are passed to the Translating Layer.

Translating Layer. In this layer the Validated Blocks undergo a translating process; they are converted into Radix-41 format if this is a Simple node, or into transparent binary if this is an Advanced node.

Radix-41: Radix-41 is a 2 byte to a 3 character packing scheme invented by Mike Wilber; the conversion from binary to Radix-41 guarantees that no control characters appear in the transmitted data which might cause undesired actions by some operating systems. Thus use of Radix-41 guarantees that PCNET will run without interference under any operating system known to us. Either Radix-41 or transparent binary can handle data in binary, ASCII or any other form, but transparent binary supports higher transmission speeds.

Framing Layer. Here the Translated Blocks have delimiting characters added, resulting in Framed Blocks.

Hardware Layer. This layer consists of the modem and any other hardware required to interface to the dial-up telephone system. Modems suitable for PCNET use are under full software control; a detailed discussion of modems may be found in Appendix A. In the modem the bytes making up the Framed Blocks are translated into serial bits, each of which is then converted into one of two audio tones for transmission over the phone line.

Now let's follow the information as it goes through the same layers in the opposite direction in the answer node.

Hardware Layer. The answer node modem converts the sequence of audio tones into a serial bit stream, and this is turned into a sequence of Framed Blocks.

Framing Layer. Here the framing characters are used to identify the block starting points; they are then discarded resulting in Translated Blocks.

Translating Layer. In this layer the blocks are translated into binary; from Radix-41 if the nodes are operating in Simple mode, or from transparent binary if they are in Advanced mode.

Validating Layer. The error detecting codes in each block are evaluated; if the block is error-free an acknowledgement block is created and sent to the originating node, indicating to it that the current block has been successfully received and that the next block may be transmitted. The error detecting code and Validated Block header material are stripped from the block, and the resulting Directed Block is passed up to the next layer.

Directing Layer. The header of the block is examined to see whether it is intended for the FTP or MAILER process in the answer node; all remaining header material is stripped off and the data is passed to the indicated process.

PRESENT PCNET ACTIVITIES

A small group of PCNET people is presently (April, 1980) working intensively to develop 1 to 4 complete implementations of the PCNET protocol running in several different computer/modem pairs. The resulting software will be in the public domain; it will be distributed to anyone at modest cost and will probably be published here in DDJ. This software is also intended to serve as 'model' software in a PCNET implementation workshop to be held later in the year. We hope this workshop will produce many additional implementations covering the majority of computer/modem pairs in use today. All this software will support real but sparse Server level processes such as file transfer and electronic mail.

A volunteer organization like PCNET is not well suited to creating and maintaining software products. It's our hope that individuals and software companies will use PCNET software as the basis for products which will utilize PCNET protocols as a telecommunication standard.

FUTURE PLANS

Although the dial telephone network is easily accessed, it is far from ideal as a PCNET medium, since it is optimized for voice and not data. Phone system bandwidth is limited and costs are high and going higher. We believe that radio offers both lower cost and higher bandwidth. US Government research has shown that many PCNET type users can effectively share a single radio frequency allocation using a technique called packet radio. The Canadian Government has wisely assigned radio spectrum space (220-225 MHz) for Canadian radio amateurs to experiment with packet radio. We'd very much like to start similar experiments in this country. Canadian experience indicates that the entire radio transceiver and interface could be built for about $500, a price which would decline with any kind of production volume. Some reports by CARF (Canadian Amateur Radio Federation) on packet radio work in Canada are reproduced in Appendix D.

The PCNET project would like to see packet radio administered under licensing much more similar to CB radio than to amateur radio. We think packet radio equipment can be designed to prevent abusive behavior by ill-informed or malicious users.

APPENDIX A

PCNET Modems

All telephone based data communication systems require modems to function. The features required for a PCNET modem are as follows:

Hardware Features

- Receive sensitivity of at least −40dBm; −45 to −50 dBm preferred
- 10 pole receive filter; 6 pole transmit filter
- 300 baud operation

Features Under Software Control

- Answer/originate mode select
- Switch hook control; pulse dialing
- Carrier detection
- Incoming ring signal detection

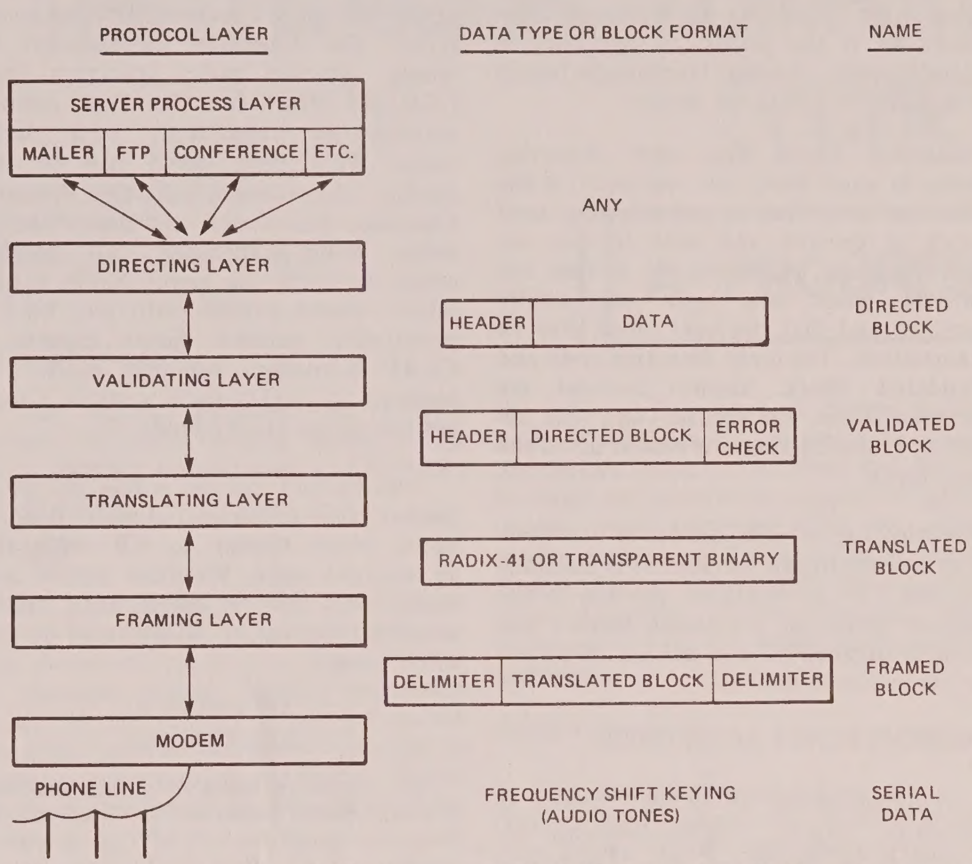
Desirable But Not Necessary Features

- FCC Part 68 registration, permitting direct connection to the phone line without an otherwise legally required Data Access Arrangement
- Telephone signalling tone discrimination, allowing software to detect DIAL TONE, BUSY, CALLED PARTY RING, etc.
- Software selectable baud rate
- Power up on incoming ring detect.

The PCNET Project has found a number of modems that are suitable for PCNET use. A list of them is given below:

TYPE – S100 Compatible

The MM–103, from Potomac Micro-Magic, Inc., First Lincolnia Bldg, Suite B1, 4810 Beauregard St., Alexandria, VA 22312. Costs $359.95; is FCC Part 68 certified.
The Micromodem-100, from D.C. Hayes



PCNET PROTOCOL LAYERS
Figure 1.

Associates, Inc., 16 Perimeter Park Dr., Suite 101, PO Box 9884, Atlanta, GA 30319. Costs $350.00; is FCC Part 68 certified.
The 88-MODEM, from International Data Systems, Inc., 400 N. Washington St., Suite 200, Falls Church, VA 22046. Costs $395.00

TYPE – Apple Compatible

The Micromodem II, from D. C. Hayes (see address above). Costs $389.00; is FCC Part 68 certified

TYPE – PET Compatible

The TNW488, from The TNW Corporation, 5924 Quiet Slope Drive, San Diego, CA 92120. Costs $320.00

APPENDIX B
PAN SOFTWARE

Just recently, the PCNET Project announced the availability of computer mail support software for use on personal computers. The software is called PAN, named for the illegitimate son of Hermes, the messenger of the Gods in Greek Mythology. The PAN software, in fact, was inspired by a sophisticated mail system called HERMES which was developed by Bolt, Beranek and Newman, Inc., for the DEC System 10 and System 20 computers.

PAN is a completely self-contained computer system. Any two PAN systems can exchange messages over an ordinary voice telephone line. PAN allows entry, review and automatic transmission of messages at times selected by the user. When a message is sent to a PAN it automatically answers the phone, receives and stores the message, and hangs up the phone to wait for the next incoming or outgoing message. Similarly when PAN has a message to be sent it automatically picks up the phone, dials the number of the recipient PAN, verifies that carrier is present and that PAN is active, transmits the message, and hangs up the phone to wait for the next transaction. Message exchange is possible between any two PAN systems regardless of the type of computer or modem used. Either or both PANs can record both incoming and outgoing messages on tape or disk.

PAN is the result of a collaboration between The Personal Computer NETwork (PCNET) Project of PCC and TNW Corporation. PAN is similar to Community Bulletin Board Systems (CBBS) in general functioning and command structure. It is different in that PAN is a distributed system; there is no single phone number and set of equipment through which all messages must pass.

The PAN system has communications advantages over both traditional mail and the telephone, and cost advantages over existing, expensive electronic mail systems.

Advantages of PAN over traditional mail:

- Immediacy of delivery (or if preferred, "time tag" delivery)
- A signal from the receiving computer allows the sending computer to mark the message "sent."

Advantages of PAN over telephone communication:

- PAN can record all received and transmitted messages for future reference
- The PAN user need not be present to transmit or receive information
- The PAN system has a "keep trying" feature which will wait until the line is clear to deliver the message.

Cost Advantages over existing electronic mail systems:

- Low entry cost
- PAN uses the dial-up telephone network
- Telephone charges can be quite low
- PAN software is available for a cost of $12, including manual
- PAN runs on a personal computer.

The present PAN system is best for letter (English language) communications. PAN is designed so that all existing computer *terminals* now in use in major universities and corporations can access PAN systems to read and write messages. Terminal-to-PAN communication is primitive due to the limited capacities of existing terminals.

The PCNET Project plans continued developments following this initial version of PAN. Some of these are detailed here:

- Improvements in the error management capabilities of PAN. At present the error rate of PAN messages is about 1 error for every .5 minutes of message transmission. This error rate is not adequate for computer programs or financial data. An error rate of 1 error for every two weeks of message transmission appears to be attainable.
- A file transfer capability will be supplied. This will allow a complete program to be sent from one personal computer to another over the telephone. Because of the low error rate the receiver of the program can be confident that the program will run successfully. This file transfer capability will allow 'bootstrap' loading of the PCNET program itself over the phone. To do this, a very short program is loaded by hand into the computer. This short program then manages the transfer of the much longer PCNET program from a remote computer via the phone line. By this process the PCNET programs can migrate from computer to computer very easily.
- The PCNET Project hopes to experiment with other than the telephone system as the communication link between PCNET computers. One possibility is radio which has the potential of markedly increasing the amount of data that can be transferred while decreasing the cost.

PAN Commands

E – Enter a message. The phone number of the PAN for which the message is intended must be in the

first line of the message. After message entry the user can select a mode assignment for the message.

I – Immediate; send this message now.

D – Deferred; hold this message for transmission later. The user is prompted for the time of transmission.

N – Make no mode assignment for this message. A mode can be assigned later as described below.

Q – Query; hold this message for subsequent retrieval by a non-PAN modem equipped computer or terminal.

M – Mode assignment. Assign a new mode to the message whose number is given by the user.

R – Retrieve a message. The message whose number is given by the user is displayed.

S – Summarize messages. The numbers, modes and initial portions of all messages in the buffer are displayed.

K – Kill (erase) the message whose number is given by the user.

U – Unload PAN, restore operating system pointers and write an end-of-file on the message record tape or disk.

? – List the PAN commands.

Modem equipped terminals or computers can send a message to a PAN system by calling the PAN and sending a special control character before the message text. A second control character after the text causes PAN to store the message and hang up the phone.

PAN has been implemented for the Commodore PET and TNW488 modem; we are working on a version for the Apple II and Hayes Micromodem II. We plan versions for the TRS-80, S-100 systems, etc.

To receive the current PAN package (a cassette tape of the PET version of PAN and a user's manual) sign and send the enclosed PAN license agreement with a check for $12 to: PCNET Project, People's Computer Company, 1263 El Camino Real, Box E, Menlo Park, CA 94025. Please also include the size of your PET's memory – 8K, 16K, etc.

We're distributing PAN under a license agreement for a number of reasons:

- We want to be sure that all versions of PAN will be able to talk to one another.
- We want to provide a central organization for the roster of PAN users, and for the distribution of new PAN versions.
- We want to protect the rights of TNW Corporation, our associate in the PAN development program.

APPENDIX C
PAN Lower Level Protocol

1. The originating PAN dials the number of the answering PAN.
2. When the answering PAN detects ring, it goes off the hook and sends carrier.
3. When the originating PAN detects carrier it sends carrier.
4. When the answering PAN detects carrier it sends the string "@@@ANN" where ANN consists of a single alpha character followed by two numerics. This string is the version number of the answering PAN; as of 6 Feb 80 it is P09.
5. When the originating PAN receives one or "@" characters it sends 5 CTRL-S characters.
6. When the answering PAN receives one or more CTRL-S characters it prepares to accept subsequent received characters as a PAN message. If no CTRL-S characters are received the answering PAN times out and goes on hook.
7. The originating PAN sends the message text. The first line of this text (between the first character and the first carriage return) contains the phone number of the originating PAN in the form (AAA)NNN-NNNN. By convention this first line also contains the sender's initials and the originate PAN local time of transmission in 24 hour format; HHMM SS where HH ranges from 00 to 23.
8. The originating PAN sends 4 CTRL-R characters to signal end of message; it then goes on hook.
9. When the answering PAN receives one or more CTRL-R characters it goes on hook and places the received character string in the message buffer. If the answering PAN loses carrier at any time during message reception it goes on hook.

APPENDIX D
Packet Radio in Montreal

This report about packet radio was prepared by Canadian Amateur Radio Federation, Inc. To be put on their mailing list, which means you will receive their next four Packet Radio Newsletters, send $5 to Art Blick at CARF, P.O. Box 356, Kingston, Ontario K7L 4W2. The money is to defray the costs of reproduction.

Since the Montreal group was the first into packet it is not unusual that this group is the furthest advanced in this technology. A system has been fully operational since August of 1979, and has been continually updated since then. There are currently six stations on the net, with more working on modems and computers right now.

The net operates on 223.5 MHZ currently, but a move to 222.3 is expected as soon as all of the stations have their crystals. Audio frequency shift keying is used, at 2400 bits per second. The mark tone is 2400 HZ and space is 4400 HZ. The modem is based on the Exar 2206. 2211 chip set, with a credit to Ted Balesta VE3CAF who first suggested the design. Having experimented with the design for almost a year now, it is capable of error-free transmission with S/N ratios of 15 DB or so. Its perfection is due to the efforts of Jacques Orsali VE2EHP who "massaged" the design to its present performance levels.

The radio is typically the Midland 13-509, running ten watts. It was chosen on the virtue of simplicity and price. The modificiations to it are simple and can be done in about thirty minutes or so. The interface to the radio was deliberately kept as simple as possible in anticipation of future users who may be either unwilling or unable to make extensive mods to the radio. Since just recently, Ted VE3CAF has joined the Montreal team, and we expect that he will make substantial improvements to the interface.

The local net is being used for man-to-man communications mostly, but lately the emphasis has switched to machine-to-machine transfers of programs, text files and the like. One user is currently writing a multi-user real time war game which will be implemented on the net soon. One of the unresolved questions is what major use the net will be put to once fully implemented. Since this will depend on the character of the users, it will stay a question for some time yet.

The network includes a store and forward repeater as part of the system, and this repeater is currently functioning. It was demonstrated at the RSO convention in the fall of 1979. It receives packets which are flagged as packets for repeating, and rebroadcasts them a few miliseconds later. It serves the same purpose as a conventional 2 meter job, i.e., it extends the range of a station using it. Since there are no cavities (it is a simplex device) it does not suffer from the usual problems of desense, and split antennas. Naturally, it is very efficient and as we say in the business, "it talks far."

The repeater operates on the same frequency as the rest of the net and only repeats pacs which are flagged to it. In this way we find two stations often using the repeater while two others who are close enough use simplex, all on the same frequency. In addition to its conventional roll, Digptr as it is called, offers other services to the users. By sending a pac to it (as opposed to through it) users can get a "Broadcast Message" which provides important information of immediate interest, system shutdowns, protocol changes and the like. The message can be changed remotely by the system operators, and is password protected. Users can also use the Digptr to check out their system. Using the Test facility, a packet sent to Digptr, will be transmitted back to the station the same way it was received, that is, with or without errors. By accessing the status file of the repeater, users can see the number of pacs, and acks which have gone through Digptr, as well as those which were "direct" and bypassed it. System operators can use this function for statistics on usage, and throughput.

The latest and perhaps most exciting development is that we now have a single board computer/terminal working. It is based on the Motorola Chroma II kit, sometimes called the TV BUG. This low cost ($300 or so) device will implement the full packet protocol in PROM, and requires only a keyboard, a TV set and a compatible modem to run. This means that the cost of a complete packet set-up is reduced by a factor of about ten. We figure about $500 including the radio would be the maximum cost for someone who had nothing to start with. For those people who have micro comptuers already, TV bug will

be able to act as a front end processor, which will handle all the communications chores for a host machine. Once this is running, we can see some very powerful and exciting possibilities for distributed processing!

The protocol currently used is a simple "Aloha" type random access system. It has been enhanced however and uses carrier sense and priority acknowledgements. Since the current protocol will probably be defunct by the time is this is published, here is the new version outline:

The Format

SYN			
SYN			
SOH			
Destin	Call	6 bytes	
Destin	Node	2 bytes	
Origin	Call	6	
Origin	Node	2	
Service	Flag	1	(bit mapped)
Number	Flag	1	(bit mapped)
Length	Byte	1	(bit mapped)
Data		0 to 256 max	
Checksum		2 bytes	

The Protocol can almost be derived by looking at the format of a packet. It is carrier sensed, that is, stations don't transmit if they hear another station on the air. Priority acknowledged, i.e., if a station hears a packet and the checksum is correct, it is presumed that the destination station also got it correctly and that an acknowledgment will be forthcoming. The transmission of a waiting packet is delayed to allow the ack to go by unhindered.

Where a station fails to get an ack to a transmitted pac, it will try again, up to three times. The interval between retries is random to avoid two stations continually clobbering each other's pacs. All pacs are preceded by an ASCII SYN (synch) byte and the ASCII Start of Header characters. The Service flag is used to indicate by setting a bit high (1) whether the packet is an ack, a repeated pac or ack, whether this is a file transfer, and ASCII or binary data field, with a couple of bits to spare. The bits are arranged as follows in this flag:

Bit	7	6	4	3	2	1	0	
	A	R	F	B	?	?	?	?

Where A = Ack
R = Pac or Ack from the repeater
F = File transfer in progress
B = Data contains binary coded info
? = Spare for future use

Note: there was a terrific temptation to rearrange the flags to read as B A R F, but in software the ARFB series was easier.

The repeat flag is used to prevent a station from receiving wo packets if he hears both the origin station and the destination. The computer will respond to and keep the one R flagged, and ignore the other. Don't forget the repeater transmitted pac will get there after the original since it is store and forward. The file flag is used to indicate that the receiving station should file the packets sequentially and not allow other packets to intrude in the file. You can imagine what getting a "Hi Bob" pac would do if it was inserted in the middle of a program I was receiving. Files are also written to disk on the receiving computer. The binary flag is used when a file (program etc.) is binary coded as this would allow us to apply offset loading etc., to the file. It will also allow a program to "come up running" on a user's machine.

The next flag in the sequence count is used to keep packets composing a file in the right order. It will also be used eventually to implement a virtual circuit where a certain number of pacs will be allowed outstanding without acks. This will allow for improved throughput with an ACK to NUMBER (X) arrangement. The length byte is obvious: it simply tells the computer how long the packet is. The only restriction is that packets cannot have more than 256 bytes in that data field. The last two bytes are the checksum which is used to establish that the packet has been received error free. This is currently done in software but we expect to do it in hardware with the Fairchild 9401 CRC generator checker chip in the final version.

AN ALPHANUMERIC LIQUID CRYSTAL DISPLAY has been announced by Crystaloid Electronics Co., PO Box 628, Hudson, OH 44236. The Alpha I is a 32 character display and includes a programable controller, display and display drive circuits. Each character (0.22 inches high) is displayed in a 5 x 7 dot matrix with a two column space between characters. The controller will interface with 8-bit microprocessors such as the 8080 or 6800. The controller includes a 64 character ASCII generator and 32 x 8 RAM for character position and display refresh. It can be programmed for display commands such as shift left or right, rotate display left-right, clear display, increment cursor and self test. A +5 V, 80 mA power supply is required. It has a power down mode which retains the contents of the display and refreshes RAM. Standby current is reduced 85% of full load. Si e is 7.5 x 2.8 x 2.5 inches. Modules are priced at $395; display only $75.

CORRESPONDENCE:

Paul,

This article* leads me to the thought of why not have a simple printer like this (from 2 mtr repeater) so hams may receive *important* notices -- including essential ones from ARRL.

That is a simple printer on one's 2 mtr receiver, on a specific repeater, at a schedule time, to receive "broadcasts" -- same idea coude be used by specialized repeaters -- i.e., DX reporting, RACES, notices, etc.

73,
Chuck, W3JPT

Ed. Note:
Sounds like a useful idea. Any members wish to comment?

*Bjoern Erikson, Swedish Telecomm Adm, "Automated Direct Printing Telegraph Systems for Transmission of Meteorological and Navigational Information to Ships". Summary: In this paper an automated system for promulgation of navigational warnings and other safety related information is described. The system comprises an automated and efficient reception on-board ships by means of a simple and inexpensive dedicated receive-only device producing the information directly on paper in written form. In addition to this an arrangement of the shor transmitting facilities is proposed to enable a rapid and suitable forwarding of information to the seafarers.

BACK AGAIN, BIGGER AND BROADER THAN EVER!

The 1980 Computer Shows For The Business & Home User.

Last year's spectacular success in Boston broadens its reach this year into the prosperous Chicago and Washington/Baltimore markets as well. The Business & Home Computer Shows are coming up again. But space is going fast. So call now if you want to be a part of the hottest thing ever in regional end-user computer expositions.

A SMASH LAST YEAR; EVEN BETTER THIS YEAR.

A record-breaking 31,000 people attended the first of these shows in 1979, a three-day affair in Boston. This year's events are broadened to four days, and will have even bigger promotional budgets than ever. *In fact, the Business & Home Computer Shows have the largest national and regional advertising budget of any computer exhibits except NCC.*

SELLING SHOWS WHERE PEOPLE REALLY BUY.

The Business & Home Computer Shows produce solid results. These are eager audiences—about 70% businessmen and the rest hobbyists—primed with purchasing power in mini- and microcomputers, word processors, peripherals, and software. They come to buy. And cash sales are permitted throughout the show.

CALL NOW! SPACE IS RUNNING LOW.

Four hundred booths and 100,000 square feet of floor space for each of the three shows may sound big, and it is. But over half that space has already been sold, mostly to last year's participants. (Several companies tried single booths last year and are back again with reservations for 12 to 16 booths!) So hurry. Call Bill Mahan or Joan Donahue at (617) 524-4547 to get more facts and assure your reservation.

WASHINGTON/BALTIMORE: D.C. Armory/Starplex, Thu., Sept. 18 thru Sun., Sept. 21.

CHICAGO: McCormick Place, Thu., Oct. 16 thru Sun., Oct. 19.

BOSTON: Hynes Auditorium/Prudential Center, Thu., Nov. 20 thru Sun., Nov. 23.

THE BUSINESS & HOME COMPUTER SHOWS™

Produced by Computer Expositions, Inc.
P.O. Box 678, Brookline, MA 02147

FINALLY AN ANSWER CONVERSION
FOR THE UBIQUITOUS BRUNINGA MODEMS

Robert E. Bruninga
907 Ninovan Rd.
Vienna Va. 22180
(through August 30th only)

Finally after a lot of work and with the help of VADIC we have the companion ANSWER modem for the ORIGINATE modems which have populated the local area. VADIC verified that the schematics are the same and that the only difference is the value of the components. A long evening with an ohmmeter and the 1 percent precision resistor tables has identified exactly those component differences in the ORIGINATE and ANSWER modems. All of the changes to make the frequencies different are resistor changes. All capacitors are identical.

Close inspection showed that the circuit card for the ANSWER (being newer) is a "rev B" whereas the entire lot of ORIGINATES are "rev A". The only difference appears to be the omission of diode D9 and the addition of two .1 power supply bypass capacitors in the vacinity of IC's M3 and M6. The D9 diode which clamps the data output to mark in the absence of carrier detect is probably omitted from the ANSWER card due to the different nature of the protocols between the two.

What follows is a table of the ORIGINATE and ANSWER values of components and a third column suggesting the easiest way to obtain those values. Notice that the first 9 entries can be changed out-right; but that the last 5 values must be tweaked with a scope, frequency counter, and a signal generator to assure the resulting conversion will live up to specs. To aid in this process, representative values for these five resistors are shown. The value in the third column is a close approximation plus about 20 percent on the high side. This is so you can add higher value parallel resistors to bring the adjustments right in.

RESISTOR	ORIGINATE	ANSWER	CONVERSION
R1	39.2	47.2	series 8.2k
R4	158.0	165.0	series 8.2k
R5	12.1	9.09	parllel 39 k
R45	6.19	3.57	parllel 8.2k
R46	6.34	3.57	parllel 8.2k
R32	6.34	3.57	parllel 8.2k
R52	6.19	3.57	parllel 8.2k
R43	16.5	17.8	series 1.3k
R44	16.5	17.8	series 1.3k
R2/R3	.43	1.5	start @ 1.8k
R7/R8	.38	1.3	start @ 1.5k
R25/R26	.33	1.0	start @ 1.2k
R23/R24	.40	1.5	start @ 1.8k
R39/R40	11.5	10.8	start @ 12 k

The R39/R40 combination sets the transmit frequency. The shift has already been set by R43 and R44 and will be within 2 or 3 Hz of the required 200 Hz. To set the frequency, be sure to have pin 18 biased to -12 volts to assure a solid mark signal before adjusting the R39/R40 combination. Once it is set to 2225 then check the space frequency by biasing pin 18 to plus 5 volts and see if the shift is within about 10 Hz of 2025.

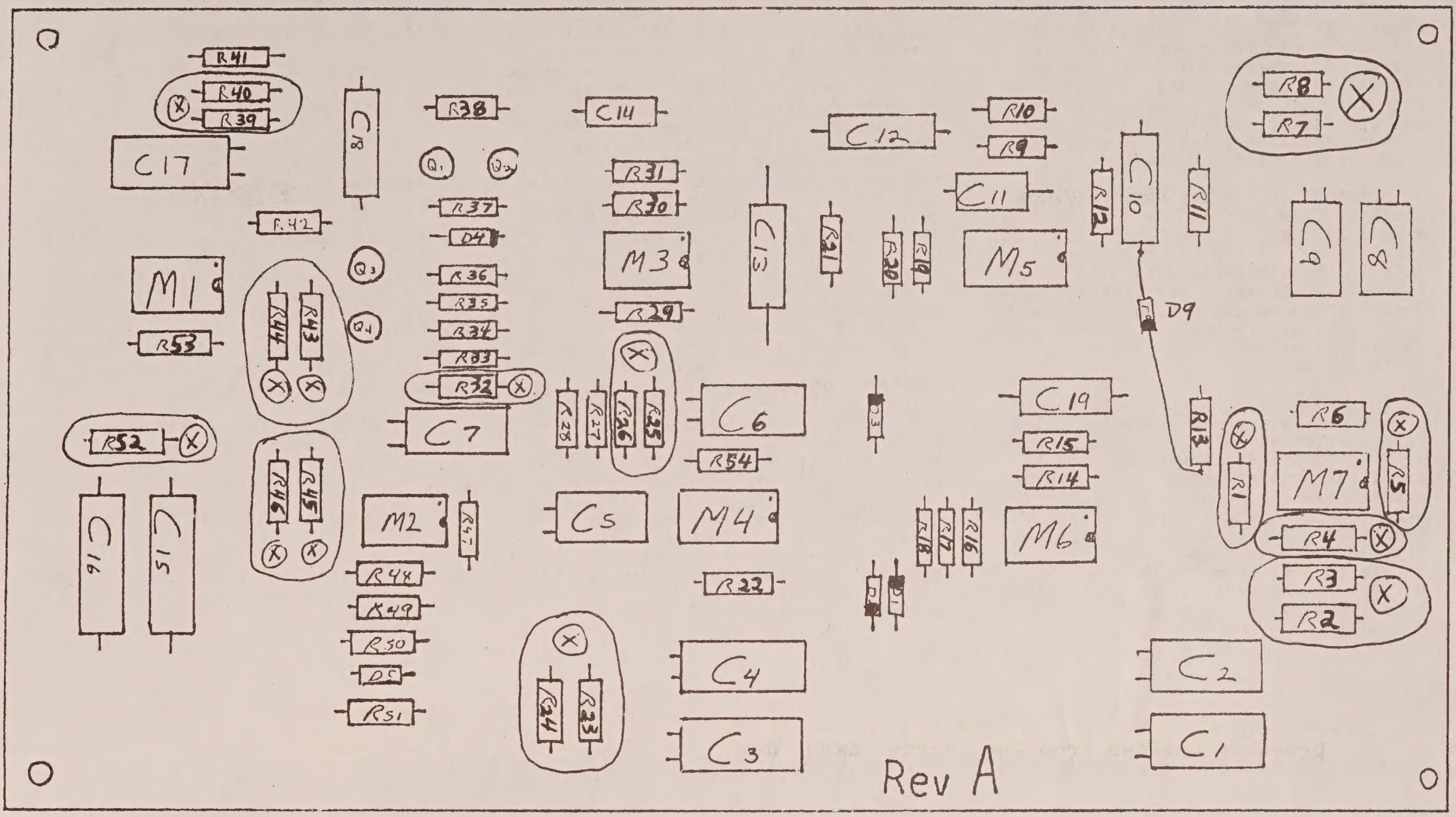
The four bandpass stages that need to be adjusted in the receiver require a little more finesse. The first two stages are stagger tuned; one for space and the other for mark. The discriminators are obviously tuned one for mark and one for space. All that is necessary is to tune each stage and the discriminators so that equal minimum levels of audio are required to activate the carrier detector and that the cross over point from mark to space occurrs at roughly 1170 Hz. The first stage can be measured for a peak of 1070 Hz at pin 7 of IC M7. The second stage can not be measured directly, but should be adjusted for an overall peak at 1170 Hz measured at pin 1 of IC M7 after the first stage is peaked at 1070 Hz. The discriminators can each be adjusted next by peaking their response for 1070 Hz at pin 7 of M4 and for 1270 Hz at pin 1 of M4. Proceeding in this order, each adjustment is independent (although based on the accuracy of the previous step.) All of these adjustments are made with the signal fed into the modem input of pin 25.

My first attempt was to do it all blind without measuring anything. Using the values measured and calculated resulted in the transmit frequency being about 25 Hz off, and the receiver showing a cross over point of 1208 Hz instead of the 1170. Also the sensitivity to the mark tone was about 2/3 that of the space tone. The modem was then adjusted as described above to bring the converted ANSWER modem to the same specs as the ORIGINATE and VADIC provided ANSWER modems. These spec values are what I measured on the bench:

Transmit frequency:	within 5 Hz
Transmit level: (600 ohm)	1.8 V p-to-p
Carrier detect sensitivity:	18 mV p-to-p
Mark/Space threshold:	within 10 Hz

Now combine this information with all of the other conversions and modifications described for these modems and you should be just about able to do anything. These modems are available from the author for $25 through August. After that time I will be on the High-Seas serving my country and the process of seeding the countryside with cheap modems will be taken over by Terry Fox at 1819 Anderson Rd. Falls Church, Va. 22043. When he runs out, both the ORIGINATE and ANSWER modems are available from VADIC at $85 each in quantities 1 to 50 or $80 each in quantities of 100 or more.

Component Layout



(X) all resistors that are circled must be adjusted as described in the text.

AMRAD **Amateur Radio Research and Development Corporation**

Membership Application/Renewal

Mail to: Gerald Adkins, Treasurer
1206 Livingston St N
Arlington, VA 22205

Dues:	Annual	Life
Regular	$12	$120
2nd in family	6	60
Full-time student	3	-

Please make checks payable to AMRAD.

Name____
Ham Call__________________ Home Phone(   )__________________

Class License_______________ ☐ARRL Member
Have: ☐2-meter FM ☐RTTY
☐Computer model____________________
Microprocessor type____________________

Address____
City, State_____________________________ ZIP______________

I agree to support the purposes of the Corporation.

*Signature*______________________________________

THE AMATEUR RADIO RESEARCH AND DEVELOPMENT CORPORATION is a technically oriented club of over 250 radio and computer amateurs. It is incorporated in the Commonwealth of Virginia and is recognized by the Internal Revenue Service as a tax-exempt scientific and educational organization.

THE PURPOSES OF THE CLUB are to: develop skills and knowledge in radio and electronic technology; advocate design of experimental equipment and techniques; promote basic and applied research; organize forums and technical symposiums; collect and disseminate technical information; and, provide experimental repeaters.

MEETINGS ARE ON 1st MONDAY of each month at 7:30 p.m. at the Patrick Henry Branch Library, 101 Maple Ave E, Vienna, VA. If the 1st Monday is a holiday, an alternate date will be announced in the *AMRAD NEWSLETTER*. Except for the annual meeting in December, meetings are normally reserved for technical talks on computer or radio subjects.

THE WD4IWG/R REPEATER is an open repeater for data communications, voice and experimental modes. It is located at Tyson's Corner, McLean, VA and has excellent area coverage. It features a semi-private autopatch available to members. Frequencies are: 147.81 MHz input, 147.21 MHz output. The repeater trustee and head of the technical committee is Jeff Brennan, WB4WLW, 7817 Bristow Dr, Annandale, VA 22003, phone 703-354-8541.

THE AMRAD NEWSLETTER is a monthly publication which is mailed to all AMRAD members, editors of club newsletters which reciprocate and others. Technical articles, new product announcements, product evaluations, news items, calls for papers and other copy related to amateur radio and computers are welcome. Classified ads are free to members. Commercial advertisement inquiries are invited. The editor reserves the right to reject or edit any portions of the copy. All items should be mailed by the 8th of the preceeding month to Paul L. Rinaldo, W4RI, Editor, 1524 Springvale Ave, McLean, VA 22101; phone 703-356-8918. Full permission for reprinting or quoting items appearing in the *AMRAD NEWSLETTER* is granted provided that credit is given. Mailing is by 3rd Class bulk mail to U.S. addresses and 1st Class to Canada and Mexico. Inquire for overseas rates.

THE AMRAD MESSAGE SYSTEM is an AMI 6800 computer bulletin board system accessible by telephone on 703-281-2125. It is compatible with originate modems in the Bell 103/113 series used in many terminals and personal computers. It automatically adjusts to either 110 or 300 baud speed upon receipt of several RETURNs when you sign on. From there it is self teaching. A sister system, VIRGINIA TTY, may be used by those with deaf TTYs by calling 703-281-1214. A handicapped educational exchange (HEX) is also operated by AMRAD. For details on any of these systems, please contact Bob Bruninga, WB4APR, 907 Ninovan Rd, Vienna, VA 22180; call him on the repeater or phone 703-281-2762.

AMRAD OFFICERS for 1980 are:

Gerald Adkins, N4GA	Treasurer
Jeffrey Brennan, WB4WLW	Director, Repeater Trustee
Robert Bruninga, WB4APR	Director, Computer Trustee, Librarian
Kenneth Coghill, WB4ZOH	1st Alt.
Terry Fox, WB4JFI	Director, Vice Pres.
William Pala, Jr, WB4NFB	Director, Secretary
Paul L. Rinaldo, W4RI	Director, President
Elton A. Sanders, Jr, WB5MMB	2nd Alt.

THE AMRAD LIBRARY is operated by Bob Bruninga, WB4APR. It is an extensive collection of amateur radio and computer magazines, books and catalogs. Donations to the library are tax-deductible -- check with the Libraian for details.

AMRAD IS AFFILIATED with the American Radio Relay League (ARRL), the Foundation for Amateur Radio (FAR), the Northern Virginia Radio Council (NOVARC) and The Mid Atlantic Repeater Council (T-MARC). AMRAD publishes a monthly column in the FAR magazine, *Auto-Call*.

TRAINING CLASSES on amateur radio and computing are run as needed by the membership. Please discuss your training requirements with any Director.

SPECIAL INTEREST GROUPS may be formed from time to time. If you are interested in joinging or forming a SIG, please contact Bill Pala, WB4NFB, 5829 Parakeet Dr, Burke, VA 22015, phone 703-323-8345.

AMATEUR RADIO RESEARCH AND
DEVELOPMENT CORPORATION
1524 SPRINGVALE AVENUE
MCLEAN, VIRGINIA 22101

Nonprofit Organization
U.S. Postage
PAID
McLean, Virginia 22101
Permit No. 1511

H S MAGNUSKI KA6M
311 STANFORD AVE
MENLO PARK CA 94025